

SPRING CHINOOK LIFE HISTORY STRATEGIES IN GRANDE RONDE AND IMNAHA

9202605

SHORT DESCRIPTION:

Investigate the abundance, migration patterns, survival, and alternate life history strategies exhibited by spring chinook salmon juveniles from distinct populations in the Grande Ronde and Imnaha River basins. This project is being implemented as an amendment to a current project #9209604.

SPONSOR/CONTRACTOR: ODFW

Oregon Department of Fish and Wildlife

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GOALS

NPPC PROGRAM MEASURE:

7.1C, 7.1D and 7.4L

RELATION TO MEASURE:

This study will provide such information as directed under three separate measures of the Columbia River Fish and Wildlife Program. This study pertains to program measures 7.1C and D in that it will provide information on abundance of parr and estimates for egg to parr and parr to smolt survival. This information is important in evaluating, critical life stages, population status, and sustainability of naturally spawning populations. This study will also provide a means for long term monitoring of juvenile production in the Grande Ronde and Imnaha River basins. Furthermore, program measure 7.4L funded the establishment of Northeast Oregon Hatcheries project (NEOH). Task 3.3.4, identified in the Northeast Oregon Hatchery Grande Ronde River Final Report is the completion of early life history studies in the upper Grande Ronde system.

BIOLOGICAL OPINION ID:

Information collected during this study relates to and will be useful for two actions described in the NMFS Hydrosystem Operations Biological Opinion. This study will provide data on multiple detections of wild PIT-tagged salmon at mainstem dams. This information can be used in evaluating in-river survivals of wild salmon. In addition, data collected during this study has been and will continue to be incorporated into the PATH life cycle modeling project. This project also directly addresses life history information needs such as rearing distribution and migration patterns critical to selecting rearing and release strategies for the Grande Ronde Basin endemic broodstocks specified in the Hatchery Biological Opinion.

OTHER PLANNING DOCUMENTS:

Precipitous declines in Snake River spring chinook salmon resulted in these stocks, including the Grande Ronde River stocks, being listed as threatened under the Endangered Species Act (October 1992). Proposed recovery efforts for these stocks require knowledge of stock specific life history strategies and critical habitats for spawning, rearing, and downstream migration (Snake River Recovery Team 1993, Northwest Power Planning Council 1992, Oregon Department of Fish and Wildlife 1990).. There is little information available on the early life history and critical rearing habitats in the Grande Ronde River basin. Recent calls for information include: a description of the spatial differences in spawning and rearing habitat (Snake River Recovery Team 1993), development of a profile on genetic, life history, and morphometric characteristics of wild and naturally spawning populations (Snake River Recovery Team 1993; Northwest Power Planning Council 1992, Oregon Department of Fish and Wildlife 1990), and evaluation of critical habitat needs and factors limiting production (Northwest Power Planning Council 1992, Oregon Department of Fish and Wildlife 1990). In addition, this project is providing valuable information needed for the development of endemic broodstocks as identified in the draft recovery plan.

TARGET STOCK

LIFE STAGE

MGMT CODE (see below)

Imnaha River Spring Chinook

juvenile, smolt

S,L

Catherine Creek Spring Chinook

juvenile, smolt

S,L

Wenaha River Spring Chinook

juvenile, smolt

S,L

Minam River Spring Chinook	juvenile, smolt	S,L
Lostine River Spring Chinook	juvenile, smolt	S,L

BACKGROUND

HISTORY:

This work has previously been funded under the Fish Passage Center's Smolt Monitoring Program. FPC dropped the project funding for fieldwork in FY 97 and entirely in FY 98. This project was implemented with reduced objectives at a funding level of approximately \$125,000.

BIOLOGICAL RESULTS ACHIEVED:

In past years, ODFW has assisted the US National Marine Fisheries Service (NMFS) with PIT tagging naturally produced chinook parr in the Imnaha and Lostine rivers, and Catherine Creek to determine migration timing at Lower Granite Dam. The migration timing information has proven valuable in developing flow and passage recommendations in the Snake River. This study expanded the NMFS tagging program to include all major populations in the Grande Ronde and Imnaha subbasins to better understand the diversity in migration patterns of naturally produced chinook salmon. Information from the expanded ODFW study has been valuable in the identification of stock management units in the Grande Ronde basin. We began PIT tagging in late summer 1992 and continued through 1996. We tagged approximately 1,000 naturally produced juvenile spring chinook salmon in the Wenaha, Minam, Lostine, Upper Grande Ronde and Imnaha rivers, and Catherine Creek. This marking was done as part of the Fish Passage Center's Smolt Monitoring Program. Preliminary analysis of the data indicates that there is interpopulational and interannual variability in cumulative detections at mainstem dams. In addition, trends in migration timing have been evident with fish from the Wenaha River arriving at Lower Granite Dam early during the migration period while fish from the Grande Ronde and Catherine Creek populations arrive late.

PROJECT REPORTS AND PAPERS:

1995. Sankovich, P., R. Carmichael, and M. Keefe. Smolt migration characteristics and mainstem Snake and Columbia River detection rates of PIT-tagged Grande Ronde and Imnaha River naturally produced spring chinook salmon. Annual Progress Report to Bonneville Power Authority. Portland, OR.

1994. Walters, T., R. Carmichael, and M. Keefe. Smolt migration characteristics and mainstem Snake and Columbia River detection rates of PIT-tagged Grande Ronde and Imnaha River naturally produced spring chinook salmon. Annual Progress Report to Bonneville Power Authority. Portland, OR.

1993. Walters, T., R. Carmichael, and M. Keefe. Smolt migration characteristics and parr-to-smolt survival of naturally produced spring chinook salmon in the Grande Ronde and Imnaha River subbasins. Annual Progress Report to Bonneville Power Authority. Portland, OR.

1992. Walters, T., R. Carmichael, and M. Keefe. Smolt migration characteristics and parr-to-smolt survival of naturally produced spring chinook salmon in the Grande Ronde and Imnaha River subbasins. Annual Progress Report to Bonneville Power Authority. Portland, OR.

ADAPTIVE MANAGEMENT IMPLICATIONS:

Results of this study will be used to make recommendations for protection and enhancement of Grande Ronde basin spring chinook populations and their critical rearing habitats. It will provide information to managers to help assess the role of tributaries in juvenile spring chinook production. Data from this study will be incorporated into the PATH model for the Columbia River basin. This project also will provide data critical to the assessment of the success of supplementing natural populations in the Grande Ronde basin under NEOH and captive broodstock programs.

PURPOSE AND METHODS

SPECIFIC MEASUREABLE OBJECTIVES:

Objective 1. Document the annual migration patterns for spring chinook salmon juveniles from six local, natural populations in the Grande Ronde and Imnaha River basins.

Objective 2. Estimate and compare smolt detection rates at mainstem Columbia and Snake River dams for migrants from six

local, natural populations in the Grande Ronde and Imnaha River basins.

Objective 3. Determine survival to parr stage for spring chinook salmon in four local, natural populations from the Grande Ronde and Imnaha River basins.

Obj. 3a. Determine the summer rearing distribution of parr and the relationship of parr distribution to redd distribution.

Obj. 3b. Estimate total abundance of parr in summer.

Obj. 3c. Estimate survival by life stage using data collected in Obj. 3b combined with smolt abundance and adult escapement data from ongoing related life history studies.

Objective 4. Investigate the significance of alternate life history strategies of spring chinook salmon in four local, natural populations in the Grande Ronde and Imnaha River basins.

Obj. 4a. Estimate the total abundance of precocious males in late summer.

Obj. 4b. Estimate the abundance of juvenile salmon that remain in freshwater past their expected spring outmigration and do not mature.

Obj. 4c. Estimate the number of two year old smolts that outmigrate past mainstem dams.

CRITICAL UNCERTAINTIES:

1. A minimum number of successful redds is needed to collect sufficient numbers of spring chinook salmon juveniles for tagging. Although this number is uncertain, we have shown that sufficient data can be obtained from as few as 11 redds in Catherine Creek.

2. Requires authorization by NMFS via Section 10 permit, which has been obtained without difficulty in past years.

BIOLOGICAL NEED:

Proposed recovery efforts for the endangered stocks of Snake River spring chinook salmon require knowledge of stock specific life history strategies and critical habitats for spawning, rearing, and downstream migration. In the past, such information has not been available for spring chinook salmon in the Grande Ronde and Imnaha river basins. It has been uncertain what alternate life history strategies existed in local populations within these basins, how the strategies exhibited might differ between populations, and how these strategies might impact survival of spring chinook salmon in the Grande Ronde basin. Recent calls for information include, a description of the spatial differences in spawning and rearing habitat, development of a profile on genetic, life history, and morphometric characteristics of wild and naturally spawning populations, evaluation of critical habitat needs and factors limiting production in the Grande Ronde basin. This study will address these needs by providing information on differences in migration timing, detection rates, survival by life stage, and alternate life history strategies exhibited in several natural populations in northeast Oregon.

More specifically, data from related projects that has been collected over the past few years has indicated that alternative life history strategies exist in local populations in the Grande Ronde and Imnaha River basins. As yet, we understand virtually nothing about the role of these alternate life history strategies. What proportion of the total population exhibit alternative life history strategies? How do these alternate strategies contribute to the success of the natural population? Providing information to address these questions will be useful in identifying and assessing wild chinook salmon stocks in accordance with the Oregon Department of Fish and Wildlife's wild fish management policy and development of broodstock guidelines and supplementation strategies for future hatchery and/or captive rearing programs.

Data collected also will be pertinent to management of flow on the mainstem Snake and Columbia rivers. Long term monitoring of the migration timing, detection rates, and juvenile population estimates has additional management value. It will elucidate population specific patterns and responses to enhancement and restoration actions that were designed to improve salmon survival and preserve life history patterns.

HYPOTHESIS TO BE TESTED:

Much of the information obtained in this study is descriptive (outmigration patterns, habitat utilization) and does not conform to hypothesis testing. There are hypotheses associated with the comparison of migration patterns and smolt detection rates at mainstem dams.

Ho1: Migration timing to Lower Granite dam is similar among local populations of spring chinook salmon.

Ha1: Migration timing to Lower Granite dam is different among local populations of spring chinook salmon.

Ho2: Dam detection rates for spring chinook salmon from local populations are similar.

Ha2: Dam detection rates for spring chinook salmon from local populations are different.

ALTERNATIVE APPROACHES:

No alternative approaches were considered.

JUSTIFICATION FOR PLANNING:

N/A

METHODS:

1. Experimental design

We will collect and mark approximately 1,500 spring chinook salmon parr from each of four streams: upper Grande Ronde River, Catherine Creek, Lostine River, and the Imnaha River. Approximately 1,000 from each river will be PIT tagged while the remainder will receive a paint mark. We will collect and PIT tag approximately 1,000 parr from the Minam and Wenaha rivers. We will use habitat and spawning survey data to determine all potential rearing habitat and then will snorkel the a stratified sample of representative habitat units to locate parr. We will collect parr by herding them into a seine set perpendicular to the stream flow or by seining in areas where herding is ineffective.

Although we will collect fish at stream temperatures up to 17oC, we will tag only at stream temperatures of 15oC or less. Fish will be anesthetized with 40-50 ppm MS-222 and PIT tags will be implanted into the parr's abdominal cavity using modified 12 gauge hypodermic needles. Needles will be disinfected for 10 mins in 70% ethanol after each use. We will record the tag code, fork length, and weight to each tagged fish. We will attempt to tag fish that are 55 mm in fork length or longer and are in good condition. We will paint mark any parr collected in excess of 1000 and all precocious males. Fish to be paint marked will be treated the same as PIT-tagged fish without tagging. The paint mark will be applied with a Pan Jet marking tool. This tool uses pressure to spray a small amount of non-toxic paint under the scales and into the dermal layer of the fish. We will examine all fish collected for evidence of precocious maturation and will collect scales from them in an attempt to determine age structure of the parr population. All fish will be released near the collection site once they have recovered from the anesthesia.

Two to three days after collection and tagging a second field crew will snorkel the same habitat units, will collect parr, and will enumerate recaptures. Handling upon recapture will be minimized to allow only identification of PIT tag code or paint mark.

These fish will be anesthetized lightly (20-25 ppm MS-222) and will be returned to the location of recapture once they recover from anesthesia. Sampling recaptures two to three days after marking allows time for fish to recover from handling and redistribute themselves and at the same time minimizes potential for immigration and emigration out of the collection area. PIT tag data will be incorporated into ASCII files and submitted to the Columbia River Basin PIT Tag Information System database. Data from mainstem Columbia and Snake River dam recoveries of PIT tagged fish will be obtained the after the spring migration season is complete. These data will be expanded based on collection efficiencies and used to compare smolt detection rates and migration patterns among populations.

2. Statistical Analysis.

-Parametric T-tests and ANOVA tests will be used to compare dam detection rates among groups. Appropriate nonparametric will be substituted if the data are found not to conform to parametric assumptions. -All analyses are subject to review by an ODFW statistician.

3. Type and number of fish to be used.

As this project involves seining and snorkeling in natural systems, the type and number of fish observed and collected is variable depending on abundances of natural populations. In 1996, we collected approximately 4,000 and PIT tagged approximately 2,800 spring chinook salmon in four streams. This study is subject to a limit of 25,000 spring chinook salmon that can be captured and handled and approximately 3,000 spring chinook salmon that can be captured, handled, and PIT tagged. Other common species collected include: summer steelhead, red side shiner, chiselmouth, squawfish, yellow perch, whitefish, largescale suckers, bridgelip suckers, brown bullhead, carp, bulltrout, crappie, largemouth bass, smallmouth bass.

PLANNED ACTIVITIES

SCHEDULE:

Implementation Phase	Start	End	Subcontractor
	a. 11/97	a. 1/98	
	b - f. 7/97	b - f. 9/97	
	g. 10/97	g. 11/97	

- | | |
|--------------|--------------|
| h. 11/97 | h. 12/97 |
| i. 1/98 | i. 2/98 |
| j. 7/98 | j. 8/98 |
| k - m. 10/98 | k - m. 11/98 |

Task Task:

- Determine all potential summer rearing habitat for local parr populations of spring chinook salmon.
- Collect and mark (PIT tag and/or paint mark) a representative group of 1,000 parr in the Minam and Wenaha rivers and 1,500 parr in Catherine Creek and the upper Grande Ronde, Lostine, and Imnaha rivers.
- Record data on length, weight, and precocious maturation from all parr.
- Collect scale samples from approximately 200 parr.
- Submit PIT tag files to PTAGIS.
- Snorkel collection areas and enumerate all parr observed and recaptured.
- Read scales and enumerate one year old and two year old smolts.
- Calculate parr population estimates, percent precocious males, and percent two year old parr.
- Obtain adult escapement and smolt production data and estimate survival by life stage for parr in Catherine Creek, upper Grande Ronde and Lostine rivers.
- Obtain mainstem dam detection data from PTAGIS.
- Determine and compare migration patterns for all six populations including migration timing, duration, and peak.
- Determine and compare dam detection rates for all six populations.
- Estimate number of two year old smolts that migrate past dams.

PROJECT COMPLETION DATE:

N/A

CONSTRAINTS OR FACTORS THAT MAY CAUSE SCHEDULE OR BUDGET CHANGES:

Spring Chinook salmon in the Grande Ronde basin are listed as threatened under the Endangered Species Act. Therefore, these research activities are regulated by NMFS and are subject to NMFS permitting for scientific take.

This project involves the handling of large numbers of naturally-produced spring Chinook salmon. Consequently, there is some risk of mortality associated with our field activities. In past field activities juvenile Chinook salmon mortality has been low, although it has varied some from year to year, mortality has remained near or below 1% of all fish captured. We have and continue to take several precautions to reduce or eliminate mortality when collecting salmon including use of passive seining techniques, use of sanctuary nets, and reducing out of water handling.

All field activities on private land are subject to obtaining permission from the landowner for access to the river.

Options for resolving these critical constraints are identified under Monitoring Approach.

OUTCOMES, MONITORING AND EVALUATION

SUMMARY OF EXPECTED OUTCOMES

Expected performance of target population or quality change in land area affected:

Results of this Juvenile Life History Strategies study will be used to make recommendations for protection and enhancement of Grande Ronde basin spring chinook populations and their critical rearing habitats. Our information will allow the Model Watershed Program and local fish managers to prioritize restoration efforts on sound scientific information. Information from this study will be useful in establishing and monitoring salmon recovery efforts in this basin. Data on juvenile production over time can be used to evaluate success of "on the ground" activities implemented. In addition, information obtained in this study on population specific differences will have implications for management of spring chinook salmon throughout their range, including information on survival to specific life stages.

Present utilization and conservation potential of target population or area:

These stocks are listed as threatened under ESA and have no current utilization potential.

Given the regional and local efforts underway these stocks have significant potential for recovery and persistence. The natural spawning escapement estimate to the Grande Ronde Basin for 1996 was approximately 900 chinook salmon.

Assumed historic status of utilization and conservation potential:

Grande Ronde basin populations were abundant and sustainable prior to completion of mainstem dams. These stocks were highly productive and supported tribal, recreational, and commercial fisheries.

Long term expected utilization and conservation potential for target population or habitat:

The desired conservation potential is that these stocks will reach full recovery and sustainability to once again support tribal and recreational fisheries.

Contribution toward long-term goal:

Regional and Grande Ronde basin recovery efforts will utilize information from this study.

Indirect biological or environmental changes:

There are no additional biological nor environmental changes that could result indirectly from this project.

Physical products:

The total number of fish that will be PIT tagged will be approximately 6,000 and approximately 2,000 fish will be paint marked.

Environmental attributes affected by the project:

No environmental attributes will be affected by this project.

Changes assumed or expected for affected environmental attributes:

N/A

Measure of attribute changes:

N/A

Assessment of effects on project outcomes of critical uncertainty:

This project will not be conducted if a Section 10, ESA permit is not obtained.

Information products:

Information products produced include monthly, quarterly, and annual progress reports, monthly activities reports to our co-managers, articles for ODFW Fish Research newsletter, as well as technical reports and presentations.

Coordination outcomes:

The outcomes of coordinating efforts of this project with others as identified include increased efficiency, transfer of information, and the development of recommendations for management that extend well beyond the scope of this project.

MONITORING APPROACH

The biological outcomes of this project can be measured by evaluating if, when, and how information produced by this project is utilized by regional fish managers in restoring and conserving chinook salmon populations in the Grande Ronde basin.

Provisions to monitor population status or habitat quality:

One objective of this Juvenile Life History Strategies study is to determine abundance of spring chinook salmon parr in tributary systems in the Grande Ronde and Imnaha river basins. This information can be used to estimate and monitor juvenile production from these tributaries over time. In addition, this study is exploring differences in life history strategies utilized by local populations and is collecting information such as migration patterns, abundance, age structure. Other projects in the basin are also collecting information important for monitoring population status including: redd counts, estimates of adult escapement, hatchery:wild ratios on spawning grounds, age composition on spawning grounds.

Data analysis and evaluation:

Statistical Analysis. Parametric T-tests and ANOVA tests will be used to compare dam detection rates among groups. Appropriate nonparametric will be substituted if the data are found not to conform to parametric assumptions. All analyses are subject to review by an ODFW statistician.

Information feed back to management decisions:

There are both informal and formal channels for communication to local and regional managers. Perhaps the most effective means of communication are through project presentations, such as ODFW biennial Research Reviews, presentations to the Grande Ronde Model Watershed, and Oregon Chapter AFS. In addition all of our project progress reports are copied to local fish managers.

Critical uncertainties affecting project's outcomes:

Each critical uncertainty affecting project outcomes could be resolved in a different fashion. Uncertainties imposed by ESA could be resolved by moving forward toward a Section 6 consultation for the Oregon Department of Fish and Wildlife or some such similar simplification of the annual permitting process. We can attempt to resolve uncertainties associated with access to private land by developing long term landowner agreements that extend for the duration of the project. Sample size uncertainties can be resolved by marking or tagging more fish than necessary to assure adequate sample sizes upon recapture. Corollary research needs include similar life history information for wilderness populations of spring chinook salmon in northeast Oregon as well as for local populations of summer steelhead.

EVALUATION

Overall project performance should be evaluated by comparing the objectives and tasks identified in the work statement to the annual progress and final completion reports. In addition, evaluation of how the information produced by this project is used by area fish managers can be used to evaluate overall effectiveness of the project.

Incorporating new information regarding uncertainties:

Any changes to critical uncertainties will be incorporated using an adaptive management process.

Increasing public awareness of F&W activities:

Oregon Department of Fish and Wildlife employees have established public outreach plans. As part of our public outreach in Fish Research, employees meet with school groups, clubs, and organizations as well as initiate articles for the local newspaper to inform the public of our activities. In the past three years project personnel have taken volunteers and school children out to participate in field activities, have given presentations to local groups, and have been interviewed for or sponsored articles for the local newspaper. We plan to continue these activities in the future.

RELATIONSHIPS

RELATED BPA PROJECT

8801804 STREAMNET: The Northwest Aquatic Information Network

9600800 PATH: Plan for analyzing and testing hypotheses

9604400 Grande Ronde Basin Spring Chinook Captive Broodstock Program

9307000 Spring Chinook Thermal Refugia: Determine the distribution, habitat utilization, movement patterns, and the use of thermal refugia by spring chinook in the Grande Ronde, Imnaha, and John day basins.

RELATIONSHIP

Provide information for use in database.

Provide data for life cycle model development

Our parr abundance surveys can provide useful reconnaissance information for locating juvenile chinook salmon for the Captive Brood study. Captive brood collection is also coupled with this fieldwork.

Data from the Thermal Refugia project will be utilized in summer and winter habitat evaluation to be completed by this project.

9403007 Grande Ronde Model Watershed Ecosystem Diagnosis and Treatment: Development of a science based approach for prioritization of habitat protection and restoration in the Grande Ronde basin.

Our project can provide information for incorporation into the EDT model.

8805300 Northeast Oregon Hatcheries Master Plan (880053): Development of hatchery supplementation strategies to enhance spring chinook natural production in the Grande Ronde and Imnaha basins.

Our project provides information on local populations that is crucial for planning and implementation of supplementation strategies in the Grande Ronde Basin.

Smolt Monitoring of Spring Chinook Salmon and Steelhead Trout on the Lower Grande Ronde River (funded under the Fish Passage Center's Smolt Monitoring Program): The project goal is to monitor and assess smolt travel time from the Grande Ronde basin to Lower Granite Dam for spring chinook salmon and steelhead trout.

Trap data will be exchanged between projects to provide in-river information on migration timing.

9202604 Spring Chinook Salmon Early Life History

Data on abundance and survival of parr will be combined with data from the early life history study to evaluate survival and critical life stages of spring chinook salmon.

OPPORTUNITIES FOR COOPERATION:

This Juvenile Life History Strategies study cooperates with numerous ongoing projects both within the Grande Ronde basin and in the Columbia River region. Information collected by our project will be utilized by other projects including but not limited to Grande Ronde Basin Captive Broodstock Program and the PATH project (see above for integration with other projects). This data integration eliminates potential duplication of efforts, increases the efficiency of project operation, and enhances the databases of these other projects. This study also provides the opportunity to monitor changes in tributary parr production and survival of wild juveniles to Lower Granite Dam over time, thereby providing information useful for evaluating 'on the ground' restoration and enhancement activities.

COSTS AND FTE

FUTURE FUNDING NEEDS:

PAST OBLIGATIONS (incl. 1997 if done):

<u>FY</u>	<u>\$ NEED</u>	<u>% PLAN</u>	<u>% IMPLEMENT</u>	<u>% O AND M</u>
1998	\$224,564	0%	100%	0%
1999	\$229,055	0%	100%	0%

It is anticipated that managers will request that we continue monitoring smolt survival and life history characteristics to generate a long term database.

1997 OVERHEAD PERCENT: 20.5%

HOW DOES PERCENTAGE APPLY TO DIRECT COSTS:

Overhead applies to a portion of the total direct costs excluding capital and contract services.
